less continues, in accordance with foreign usage, to quote the law Boyle discovered as "Mariotte's." He also gives a figure illustrating Cavendish's method of demonstrating the law of the inverse square in electrostatics, but the name of Cavendish is not mentioned, and the figure is labelled "Coulomb's Law."

It is probable that the historical motive is to be held responsible for the retention of many old experiments and figures of archaic apparatus. This is in many cases most desirable and instructive, provided always that the later developments are explained and illustrated so as to point the contrast. The experiments of Wheatstone (1834) on the "velocity of electricity" are of the highest interest and educational value, but it is not fair to leave the student with the conclusion, "Both electricities pass, then, simultaneously from the coatings of the jar, and meet midway between them. The velocity of propagation in a copper wire was found to be 430,000 km. By a different method Siemens (1876) found for the velocity in an iron wire 240,000 km." Again, it is certainly instructive to give a figure of the early type of German mirror galvanometer with a massive four-inch bar magnet inside a rectangular coil, but it is a mistake to ignore the essential improvements introduced by Thomson (Lord Kelvin), and to leave the student with the impression that the instrument figured is the type of a modern sensitive galvanometer. Similarly, in the section on the liquefaction of gases, we have an illustration of Pictet's historical apparatus (1877), and we are informed that "Hydrogen was liquefied at a pressure of 650 atmospheres and a temperature of $-140°$. On opening the tap an opaque stream of liquid of steel-blue colour escaped, at the same time the solidified hydrogen upon the floor produced a rattling sound as of falling shot." It is stated on the previous page that the critical temperature of hydrogen is $-174°$. No later experiments are mentioned. Such omissions as these can hardly be justified even in the most elementary work, and cannot fail to produce the impression that the book is not sufficiently up to date to satisfy the requirements of modern scientific education.

In endeavouring to explain a new term, it is often considered necessary in elementary text-books to put the idea into somewhat vague and general language, rather than in the form of a precise definition, because the more exact statement may fail to convey the idea intended. We are inclined to doubt the wisdom of this course, which appears to be carried too far by the author. The following are a few samples of the kind of statement to which we refer.

P. 24. "*Work.*—When a force acting on a mass sets it in motion, the force is said to do work, and the result of its action is called work." "In transforming forces into work, the question is not alone whether work is done, but also in what time it is accomplished. The work done in one second is called the 'effect' of the force."

P. 289. "*Equilibrium in Conductors.*—When a conductor has attained a condition of electrical equilibrium, the electrical forces, and accordingly also the electrical potential, are everywhere 0. This merely says that in a position of equilibrium, every point in and upon a conductor has the same potential."

P. 372. "*Wheatstone's Bridge.*—If the branches *amb* and *anb* of the current are connected by a cross wire *mn*, called a 'bridge,' two currents flow in opposite directions in the bridge. If these currents have equal strength they neutralise each other and no current passes through the bridge. . ."

P. 377.—"Edison's (1879) incandescent lamp depends upon the heating action of the current. A charged filament of hemp, or cotton, of high resistance (*e.g.* 140 ohms) and bent into the form of a horseshoe, is enclosed in an exhausted glass globe to protect the filament from burning, while a current of about 100 volts passing through it heats the filament to incandescence, giving it an intensity of approximately fifteen candles." (Nothing more is said on the subject of incandescent lamps.)

The paragraphs "in fine print" contain the majority of the formulæ, and are intended to meet the needs of higher schools and colleges. They appear, however, to be of too disconnected and occasional a character for the purpose. A good deal of small print, *e.g.* three pages on thunder and lightning, is of very elementary and purely descriptive character. On the other hand, some rather difficult points are discussed in the "coarse print," *e.g.* the "Second proposition of the Mechanical Theory of Heat. Entropy. Kinetic theory of gases." In discussing the Second Law of Thermodynamics and the Dissipation of Energy, no allusion is made to reversible cycles, and the information imparted is necessarily so incomplete that no application could be made of it. Mayer's calculation of the mechanical equivalent is given, but Joule's experimental verification of the assumption upon which it rests is entirely ignored. It may be questioned whether there is any profit in introducing such points if they cannot be adequately discussed. It is not very easy to follow the principle upon which the selection or omission of subjects for discussion is based. The book as a whole does not appear to be sufficiently definite and practical to be suited for class or examination work according to English standards. It is possible that it may be more suited to the methods in vogue in Germany or America.

HUGH L. CALLENDAR.

TWO NEW ZOOLOGICAL HANDBOOKS.

A Manual of Zoology. By the late Prof. T. J. Parker and Prof. W. A. Haswell. Pp. xv + 550. (London: Macmillan and Co., Ltd., 1899.)

An Elementary Course of Practical Zoology. By the late Prof. T. J. Parker and Prof. W. N. Parker. Pp. xii + 608, with 156 Illustrations. (London: Macmillan and Co., Ltd., 1900.)

PROFS. PARKER AND HASWELL have embarked upon a difficult and somewhat ambitious undertaking. To compress an account of practically the whole animal kingdom, with 300 illustrations, into a handbook of 550 pages, intended for beginners, is certainly no light task at the present day. Such manuals were quite possible so long as it was considered sufficient for a book of this kind to deal with the exteriors and the habits of animals, and to consist for the greater part of illustrations of monkeys, beasts and birds, while about one-fifth or less was taken up by reptiles, fishes and insects, with perhaps a figure or two of zoophytes or diatoms from Barbados earth. But

the book before us is nothing if not scientific and modern in its treatment of the subject. It attempts in the first place to do justice to the claims of every one of the principal existing groups of animals, fairly and without favour or prejudice, giving an outline of the structure and morphology of the more important types in each class. In the second place, it introduces the reader to the fundamental conceptions and problems of zoology, such as evolution, classification and phylogeny, distribution in space and time, conjugation, fertilisation, development, and the cell theory. In a work of scope so wide and comprehensive, with at the same time such narrow limits of space, it requires much care and ingenuity to steer a just course between the Scylla of over-condensation and perplexity and the Charybdis of vague incompleteness. The inexperienced reader becomes bewildered, in the first case with excess, and in the second with lack of detail, so that he is at a loss how to sort out, or how to connect, the material which he absorbs. The danger is, therefore, that a treatise of this kind may be used less by the beginner, who requires to be stimulated and interested, than by the more advanced student, who desires merely to "look up" work he has done; in other words, that it may degenerate into a mere cram-book. It must be admitted, however, that if it is possible to succeed in such a task, the authors have done so. The book contains a great store of information, chosen with judgment and set forth with skill. In order to avoid as much as possible the dangers above pointed out, the authors have restricted the extent of ground covered by leaving out some of the less important groups, such as Chimæroids among fishes, by omitting all descriptions of extinct groups, and by dealing only very briefly with embryology. Perhaps the chief value of the work is in its numerous and admirable illustrations, of which the authors had a copious stock to draw upon in the pages of their larger two-volume "Text-Book." Amongst them are some coloured diagrams of the circulation of the blood in various types, for the most part clear enough, but Fig. 204, illustrating the circulation of a fish, certainly requires a good deal of looking at before its meaning can be grasped. The book is intended, we are told, principally for the requirements of the students in higher classes of schools; but is it necessary, even in this educational stratum, to explain the meaning of commensalism by coining and printing such a word as "messmateism," which looks at first like some new form of theosophy? These are, however, but minor points. Judged as a whole, the book is one which fills a distinct gap in zoological literature, and fills it well, as a handy book of reference, though we are inclined to think that the authors have attempted rather too much, and that the class of readers who will benefit most by their work will not be quite those for whose use the book was intended.

The second book mentioned at the head of this notice will be welcomed by many as a handy and inexpensive manual of zoology adapted to the needs of elementary, and especially medical, students, which is at the same time free from the faults and vices of the harmful, unnecessary cram-book. It is written on the same plan as the well-known "Elementary Biology" of Huxley and Martin; that is to say, a certain number of types are selected, and a connected account of each one is given first, after which follow practical directions, necessarily rather brief, for its study and dissection. The examples selected are *Amoeba* and some other unicellular organisms, illustrative of the differences between animals and plants; *Hydra* and *Bougainvillea*; the earthworm, crayfish and pond-mussel; and the amphioxus, dogfish, frog and rabbit. The frog is taken first and dealt with in detail, occupying nearly half the book, as an introduction to biology in its various branches—anatomy, physiology, histology, embryology, classification and various biological problems. Then follow the descriptions of the other types, beginning with the unicellular forms and ending with the vertebrates; and a final chapter deals with the cell and with fertilisation and embryology. The illustrations are numerous and useful, some of them from familiar clichés, others appearing for the first time. The book, it may be safely predicted, will become popular and will run through further editions, in which, doubtless, alterations will be made to keep it up to the level of advances in science. In the present issue, the most recent standpoint of vertebrate embryology is not quite adequately represented. Thus more might have been made of the frequent occurrence of what may be termed the amphioxus stage in the embryonic development of many systems of organs in Craniata, as for instance the appearance, in the development of the vascular system, of a splanchnopleuric subintestinal vein, prior to the formation of the somatopleuric system represented by the cardinal veins, &c., and the origin of the heart itself from the anterior portion of the former system. Again, in the urogenital system the differences between pronephric and mesonephric tubules, both in development and structure, and the homology of the former with the excretory tubules of amphioxus, might at least have been alluded to. The authors do not raise the question as to whether pronephric and mesonephric tubules are to be regarded as homodynamous or not, but leave one rather with the impression that they are; it is surely time now, however, that the English, no less than the German, student (and, for that matter, the English teacher and examiner also) should be told clearly that they are not. The concluding chapter of the book might, in fact, have its interest, as well as its value, increased in many particulars, without adding half a page to its length. But this detracts little from the usefulness of the book as a guide and help to the student and teacher of zoology, and as such it may be confidently recommended.

E. A. M.

THE TEACHING OF METEOROLOGY.

Practical Exercises in Elementary Meteorology. By Robert DeCourcy Ward, Instructor in Climatology in Harvard University. Pp. viii + 195. (Boston, U.S.A.: Ginn and Co., 1899.)

MR. ROBERT D. WARD has written a book for the use of schools and training colleges, which we should think would be very popular with teachers and pupils alike. With the former, because he indicates to them the proper method of giving instruction in meteorology, and, at the same time, supplies so many valuable hints, that he makes their work more profitable, without